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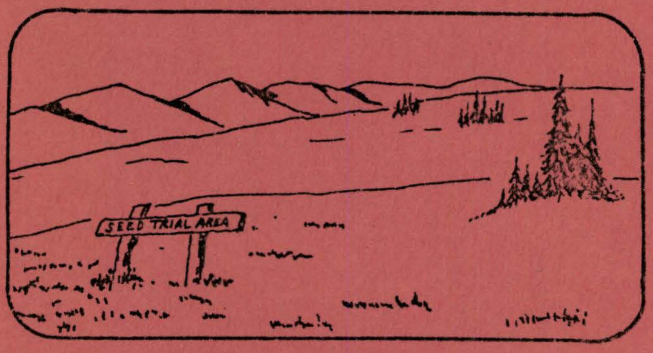
A HISTORY OF HIGH ELEVATION RANGE RESTORATION ON THE BRIDGER NATIONAL FOREST



ANDREW YOUNGBLOOD
JANUARY 1983

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PLANTING SURVIVAL

A HISTORY OF HIGH ELEVATION RANGE RESTORATION ON THE BRIDGER NATIONAL FOREST

Andrew Youngblood
Plant Ecologist

Bridger-Teton National Forest
January 1983

INTRODUCTION

Current and future management activities on the Bridger-Teton National Forest in western Wyoming involve revegetation of many acres of disturbed land at high elevations. Activities may consist of highway or road construction or restoration, mineral or energy exploration and field development, and watershed restoration following wildfires, abusive livestock grazing, or recreational developments. Resource managers need approved methodologies and practices which will result in the achievement of a variety of revegetation goals. These may range from the mandated protection of the soil and water resource to a complete rehabilitation resulting in a return to predisturbance conditions in any given time period.

The purpose of this paper is to report on several studies designed to test plant species survival and suitability for seeding mountain rangelands. Recommendations are provided for resource managers which should help in developing site specific revegetation plans in conjunction with management activities.

BACKGROUND

During the late 1940's and early 1950's, personnel of the Bridger National Forest (now Bridger East and West Divisions of the Bridger-Teton National Forest) became aware of the depleted mountain rangelands and of problems associated with reseeding these sites. Research proposals were drafted to test the significance of a number of factors in contributing to reseeding failures. Five study sites were designated and studies initiated with the cooperation of the USDA Agricultural Research Service; USDA Forest Service - Intermountain Forest and Range Experiment Station; US Fish and Wildlife Service; Northrup-King Company; Earp Laboratories; and Utah State Agricultural College (now Utah State University). Each of the five sites are part of a former sheep driveway, and are identified on the map in Figure 1. Appendix Table 1 provides a listing of the species planted at each site. The following is a brief description of the sites, objectives of the study, and method and practices that were applied.[1/]

McCain: The McCain site, near McCain Guard Station, lies near the upper end of a broad flat basin, drained by the Little Greys River. Soils are characteristically a clay loam in texture, well-drained, and are derived from alluvium that mantles mixed sedimentary rocks. The surrounding dominant vegetation types include riparian communities such as Carex rostrata, Poa pratensis, and Salix boothii/P. pratensis community types as described by Norton (1981), sagebrush-dominated grasslands best described as Artemisia tridentata vaseyana/Festuca idahoensis and A. cana/F. idahoensis habitat types (Bramble-Brodahl 1978), and timbered slopes dominated by Pinus contorta. These forest stands belong to the Abies lasiocarpa/Vaccinium globulare-V. scoparium, A. lasiocarpa/Berberis repens, or A. lasiocarpa/V. scoparium-Calamagrostis rubescens habitat types, as described by Steele and others (1979).

1/ Detailed study plans on file, USDA Forest Service, Bridger-Teton National Forest, Supervisor's Office, Jackson, Wyoming.

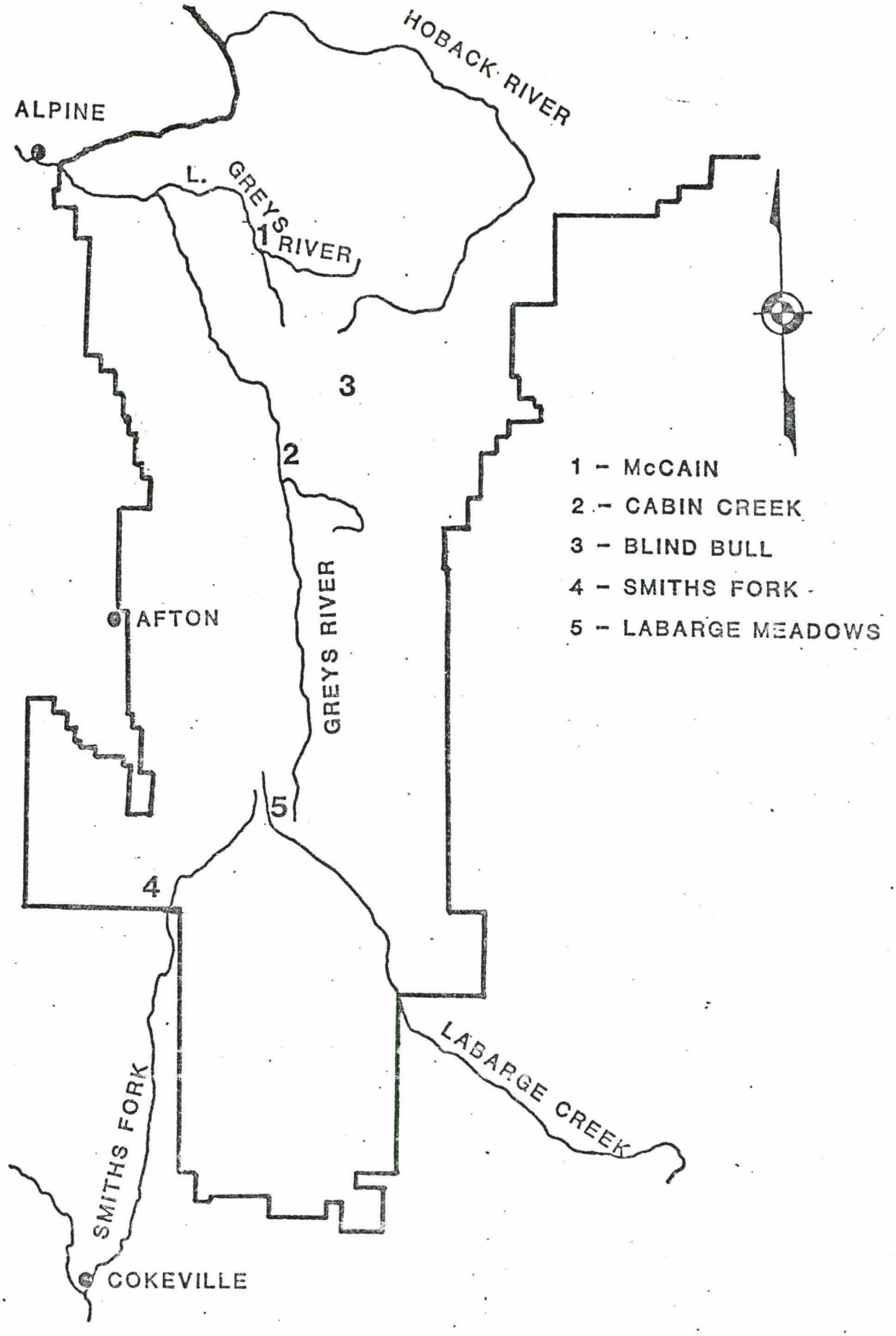

Figure 1. Location of five seed trial sites on the Bridger-Teton National Forest in western Wyoming.

The study site (lat. 43°7'4", long. 110°42'30") is at 6,850 feet (2,089 m) in a dry meadow belonging to the Artemisia cana/Festuca idahoensis habitat type, as described by Bramble-Brodahl (1978). The meadow had been plowed and aerially seeded in 1949 and 1950 for hay production. This treatment was apparently a failure, with only spotty production in areas that could be irrigated. The cause of failure was attributed to a variety of factors, including competition from perennials and annuals, adverse weather, rodents, and utilization by a number of herbivores, including grasshoppers, crickets, elk, deer, and cattle.

A 1.25 ac (0.51 ha) exclosure was established and two 0.5 ac (0.2 ha) blocks cultivated and harrowed with a garden tractor and spike tooth harrow. Dense growth of Geranium and Potentilla prevented complete plowing. Planting occurred in early October 1953 and mid-July 1954, and consisted of five rows in 5 by 20 feet (1.5 by 6.1 m) plots using a garden seeder. Single species and mixtures of different species were broadcast seeded and raked.

This site was included in study plan C-162 by the Agricultural Research Service. The objective was testing seed germination and survival, the effect of weedy plant competition such as Gayophytum diffusum (= G. nuttallii Torr. & Gray), Polygonum douglasii, Madia glomerata and existing perennials, and the effect of pocket gophers on the reestablishment of high elevation rangelands.

Cabin Creek: The Cabin Creek study site (lat. 24°52'27", long. 110°41'21") is a corridor between the Greys River and the Greys River road at 6,790 feet (2,071 m) elevation, opposite the confluence with Cabin Creek. The site is south of Meadows Guard Station and north of Sheep Creek. The flat or very gently sloping alluvial bench belongs to the Artemisia cana/Festuca idahoensis habitat type (Bramble-Brodahl 1978). At the time of establishment the dominant vegetation was Artemisia cana, A. tridentata-vaseyana and annual weeds with most perennial grasses removed through heavy grazing. Soils are similar to those at McCain.

A 1.25 ac (0.51 ha) exclosure was constructed and six 40 by 60 feet (12.2 by 18.3 m) blocks laid out. Artemisia and some Eriogonum plants were grubbed with a hoe and then the blocks cultivated similar to the McCain site. Planting took place in early October 1953, and early July and late September 1954. The plots were then rolled with a lawn roller. Additional land was plowed or sprayed with 2,4-D and then planted using a hand seeder during 1957.

The Cabin Creek site was included in study plan C-162 by the Agricultural Research Service. It was originally selected on the basis of providing a replication of the test at McCain, and in addition, would serve as a demonstration site because of the close proximity to the Greys River road.

Blind Bull: The Blind Bull site (lat. 42°57'2", long. 110°37'14") is at 8,870 feet (2,705 m) on a ridge dividing Blind Bull Creek (Columbia River Basin) to the north and Horse Creek (Colorado River Basin) to the south. The high, gently rolling forb meadows are characterized by Geranium viscosissimum, Balsamorhiza macrophylla, and Helenium hoopesii with stringers of Artemisia tridentata-spiciformis. Frost pockets that collect moisture usually support Veratrum californicum. Surrounding forested slopes belong to the Abies lasiocarpa/Ribes montigenum habitat type as described by Steele and others (1979). Soils are characterized by being deep, with dark silt loam surface horizons and clay loam subsoils and are derived from Cretaceous sandstones and shales.

Cultivation and site preparation follows that of McCain. Planting occurred in early October 1953, and June and late September 1954 and was designated as part of study C-162 by the Agricultural Research Service.

Smiths Fork: The Smiths Fork site (lat. 42°29'19", long. 100°51'42") lies at about 7,700 feet (2,349 m) on a gentle east-facing slope just south of the old Smiths Fork Guard Station, within the Smiths Fork demonstration watershed area. The area was described at establishment as a depleted aspen park; aspen stands immediately adjacent belong to the Populus tremuloides/Arnica cordifolia community type as described by Youngblood and Mueggler (1981). Soils are characteristically silty clay loams, low in organic matter and nitrogen, and have a moderately slow infiltration rate. The site at the initiation of the study was dominated by annual weeds such as Madia glomerata, Gayophytum diffusum, and Polygonum douglasii.

The objective of this study was to determine proper species, methods, fertilizers, and mulching treatments suitable for successful seeding in depleted aspen openings and also to determine the effect of pocket gophers upon the establishment of the plantings. The site was plowed to a depth of five inches (1.97 cm) and planted with a drill in mid-June 1955. Treatments consisted of species plots 10 by 35 feet (3.1 by 10.7 m).

Fertilizer applications of nitrogen and/or phosphorous at 50 and 100 pounds per acre (56 and 112 kg per ha) and organo at 2,000 pounds per acre (2,240 kg per ha) covered all species plots. Mulching consisted of either straw applied for a 0.5 to 0.75 inch (1.3 to 1.9 cm) deep covering or sawdust to a depth of 0.25 inches (0.68 cm). All treatments were represented in each of two replicate blocks. Rodent effects were evaluated in four exclosures, each 50 feet (15.25 m) on a side. These plots were plowed, planted with a mixture of equal parts of all species, fertilized, and lightly mulched with straw.

The Smiths Fork site was designated as study C-164 by the Agricultural Research Service.

LaBarge Meadows: The final seed trial site (lat. 42°31'23", long. 110°41'19") is just south of the Tri-Basin Divide, which separates the Greys River and the Columbia River Basin to the north, Smiths Fork and the Great Basin to the west and LaBarge Creek and the Colorado River Basin to the east. It is on the west side of the LaBarge Creek road, with LaBarge Creek Guard Station approximately one mile to the south. Elevation is approximately 8,660 feet (2,641 m) and the aspect is southeast. Soils on the gentle slope are mostly sandy loams. The dominant vegetation characterizing the site includes Artemisia tridentata-spiciformis, Balsamorhiza macrophylla, and Geranium viscosissimum. Surrounding coniferous forests belong to the Abies lasiocarpa/Ribes montigenum and A. lasiocarpa/Vaccinium scoparium habitat types, as described by Steele and others (1979).

The LaBarge Meadows study was the earliest site on the Forest selected for testing a variety of plant species applicable for high elevation areas that may have been inaccessible to more common seeding equipment. The six acre (2.4 ha) exclosure contained a variety of treatment plots to evaluate individual plant species and mixtures, seed bed preparation, seeding methods, and herbicide application. The disking that occurred was done with an offset disk

harrow pulled by a tractor. Leveling and seed covering involved pulling a V-type meadow renovator of heavy timber and railroad spikes, or a rectangular drag with bridge planks. Planting involved either a hand drill or whirlwind hand broadcaster, and took place in middle and late June, and mid-September and October 1951. Areas receiving a commercially prepared mixture of 245-T and 24-D in June or July were broadcast seeded with a species mixture or left unplanted.

EVALUATION METHODS

Establishment reports for each seed trial site provide only a limited insight into the original evaluation procedure. In general, plant species were numerically rated using an eleven-point system ranging from zero for a failure to ten for an excellent stand. This ocular rating involved both plant vigor and density. Ratings were compiled for the first three years following planting, each year from 1958 through 1961, and then during 1967 and 1970. There was apparently no evaluation of the McCain site during 1970 and an additional evaluation was made at LaBarge Meadows during 1972. During 1980 and 1981, the five study sites were revisited, allowing for almost a 30-year summarization of survival and adaptability.

Gopher-proof exclosures were maintained during the early part of the studies. Exclosures were removed at Cabin Creek and LaBarge Meadows before 1968, and McCain was converted to a horse corral. Blind Bull and Smiths Fork exclosures were apparently no longer maintained after this time; the condition of these exclosures during 1980 indicated a considerable period of disrepair.

During 1980 and 1981, no attempt was made to reconstruct the individual species plots. In a few instances when numbered or labeled stakes were found, the indicated plot location was questionable. This was usually the result of rodent activity and almost continual surface disturbance. The working theorem was that over a period of almost 30 years a successful species should be well represented throughout the entire planting site as a result of vigorous regeneration. Ratings for the first few years should indicate a particular plant species ability to survive under different abiotic influences, whereas later ratings involve both abiotic and biotic factors.

Apparently no consistent evaluation was made of the effects of fertilization or mulching treatments. Also, after the first few years, differences between seasons (spring or fall planting) were nullified by reporting only a single rating for each species or mixture.

RESULTS AND DISCUSSION

Results will be discussed in terms of each seed trial site individually followed by a brief comparison of the major plant species. Finally, the effects of rodents are summarized.

McCain: Native grasses began reestablishment immediately following site preparation and planting. By 1955, they had developed a good cover. Seeded species showing vigorous growth included *Phleum pratense*, *Dactylis glomerata*, *Agropyron intermedium*, and *Bromus carinatus*. In general, the fall plantings were twice as successful as those of the spring. The mixtures were considered excellent. However, it is not known to which individual or combination of species in the mixture the rating applies.

By 1960, Bromus inermis and B. carinatus were rated the highest of all individual species being tested at this site; however, the rating was only a medium (5-6). Arrhenatherum elatius, Dactylis glomerata, and Phleum pratense, which were considered in excellent condition for the first few years, exhibited very poor growth starting in 1956. Agropyron trachycaulum also experienced a steady but much more gradual decline. The mixture containing Bromus inermis and Alopecurus pratensis, which was broadcast seeded, rated the highest (good) of all treatments.

Currently, the horse corral at McCain is dominated by both Bromus inermis and Alopecurus pratensis. Artemisia cana, A. tridentata-vaseyana, and A. ludoviciana are slowly invading.

Cabin Creek: Evaluation reports indicate that all plantings before the fall of 1954 were completely unsuccessful due to dry summers. By 1961, those areas that had been reseeded in 1957 with a mixture containing both Agropyron trichophorum and A. intermedium were considered good to excellent. This rating applies only to plots that were plowed; a site preparation by spraying resulted in only poor to good stand development for the same species. The 1967 and 1970 evaluation indicate a gradual increase in the relative prominence of Alopecurus pratensis (medium), and the continued dominance of the two Agropyron species (excellent). Planted forbs, all belonging to the Fabaceae family (Leguminosae), proved to be completely unsuitable for this site.

Currently, the entire planting site is rapidly converting to an Artemisia-dominated steppe (Figure 2). Alopecurus pratensis (Figure 3) appears to have reached a codominance with Agropyron trichophorum and A. intermedium. Native grasses and forbs have also become established, including Poa nevadensis, Festuca idahoensis, Achillea millefolium, Eriogonum heracleoides, and Aster foliaceus. The area has received heavy grazing pressure in recent years; this tends to be concentrated in the interspaces between Artemisia clumps.

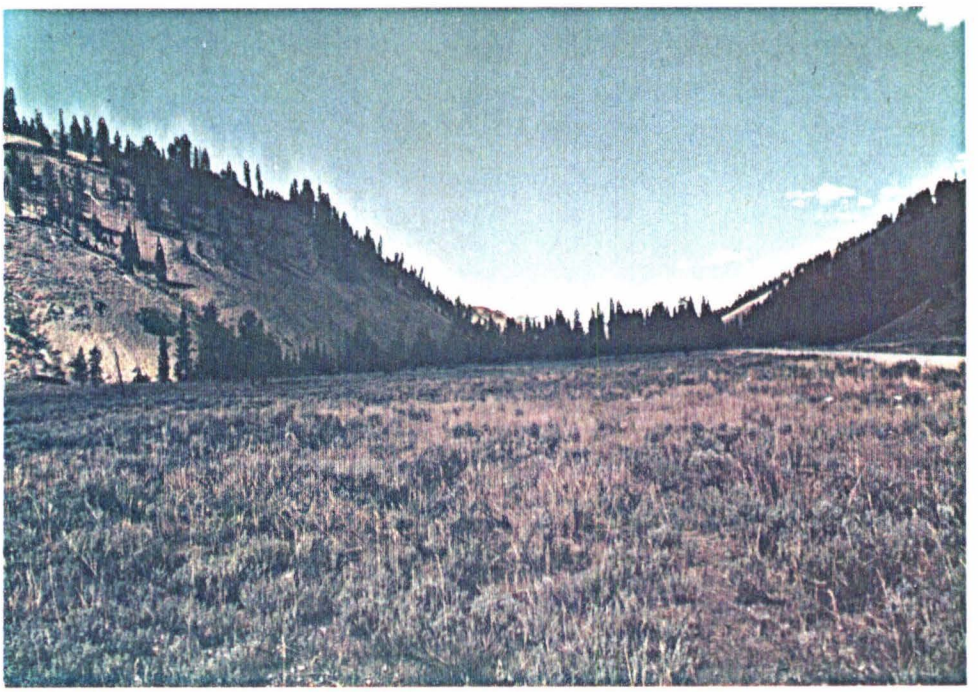

Figure 2. Cabin Creek seed trial site, sloping westward toward the Greys River. Artemisia tridentata-vaseyana is the dominant shrub; Agropyron spicatum and Bromus inermis appear in the foreground, and Agropyron intermedium, Bromus carinatus and Alopecurus pratensis are in the center. Date 9/11/81

Figure 3. Cabin Creek Site. Alopecurus pratensis with reestablishing Artemisia cana. Date 9/11/82

Blind Bull: This is the highest elevation site, and thus should represent the most severe conditions with shortened growing season. However, moisture is probably not as limiting as other sites. Similarly to the previous two sites, those plots which were plowed and then planted in the fall were the most successful. Also, Alopecurus pratensis and Bromus inermis exhibited the best growth by 1960. It is interesting to note that a few species which did not survive past the first few years seem to have good early growth when planted in the spring. Examples of these are Phleum pratensis, Dactylis glomerata and Arrhenatherum elatius. In contrast, those species which have good to excellent growth are usually those planted in the fall.

By 1981, the only species surviving was Alopecurus pratensis, which has spread by rhizomes throughout the site on the northeast-facing slope (fig. 4). However, the influence of aspect (presumably its effect on moisture stress) is indicated by the difference in vegetation on the southwest-facing slope (fig. 5). Graminoids are essentially absent, and the dominant forbs include Helenium hoopesii, Polygonum douglasii, Rudbeckia occidentalis, Madia glomerata, and Gayophytum.

Figure 4. Blind Bull seed trial site, northwest corner of exclosure. Dominant seeded grass is Alopecurus pratensis. Invading native forbs are mostly Potentilla glandulosa, Aster foliaceus and Helenium hoopesii. Date 8-25-81

Figure 5. Blind Bull site, southwest-facing corner. Note the gopher mounds and the high cover of annuals. Date 8-25-81.

Smiths Fork: Early evaluation reports indicate a high degree of establishment of wheatgrasses, particularly Agropyron intermedium, A. anurense, and A. tricophorum. These species were considered medium (5-6) or better during 1958, and improved to excellent (9-10) by 1967. Unlike the previously discussed sites, the Smiths Fork proved to be unsuitable for Alopecurus pratensis. It apparently represents conditions producing sufficient moisture stress to inhibit successful growth and establishment following germination. Arrhenatherum elatius apparently failed to germinate. The two forbs, Medicago and Astragalus, never received a rating above very poor (2) and poor (4), respectively. The two species of Bromus were very slow to establish; both were almost consistently very poor (2) through 1961. However, Bromus inermis began to expand and increase in vigor prior to 1967, when it was considered medium (5).

Species composition on the site has apparently changed dramatically during the last decade. Bromus inermis now dominates, with an indigent representation of most other planted species. Agropyron trichophorum accounts for about ten percent cover, with A. intermedium, Phleum pratense, Alopecurus pratensis, Dactylis glomerate, and Medicago sativa present in trace amounts. Although abundant along the perimeter of the site, mountain sagebrush (Artemisia tridentata - vaseyana) has failed to seed into the plantings (figure 6).

Figure 6. Smiths Fork seed trial site, facing north. Dominant grass is Bromus inermis; Agropyron trichophorum appears as scattered, very light tan clumps. Note lack of Artemisia establishment. Date 9-14-81

LaBarge Meadows: Early records from the LaBarge Meadows planting site would imply that this was one of the most successful revegetation attempts of its kind. By 1953, eight of the twenty-four species planted during the spring of 1951 were rated as medium or better. These eight grasses were Agropyron cristatum, A. intermedium, A. subsecundum, A. trichophorum, Bromus carinatus, B. inermis (common), B. inermis (Lincoln), and Phleum pratense. In contrast, only Agropyron intermedium, A. subsecundum, and Bromus carinatus, planted during the fall of 1951, rated medium or better. This trend appears to continue through 1967, when five species, Agropyron intermedium, Alopecurus arundinaceus, A. pratensis, Bromus inermis (common) and Bromus inermis (Lincoln), rated medium or better. The same year, only Arrhenatherum elatius, planted during the fall of 1951, was rated as medium. The fall plantings of wheatgrasses were considered very poor or a failure. By 1970, the only species which were considered better than very poor were Alopecurus arundinaceus and Arrhenatherum elatius, which rated as poor (4).

Native vegetation has begun to dominate the site. The 1981 survey revealed high coverage of Artemisia tridentata-spiciformis, Balsamorhiza macrophylla, Geranium viscosissimum, Achillea millefolium, and Aster foliaceus (fig. 7). Agropyron intermedium and Arrhenatherum elatius appear to be fairly static. Agropyron cristatum is present in one small patch, the result of a broadcast seeded mixture in June 1951. It has failed to regenerate outside of this immediate area. Elsewhere, when planting was a complete failure, sheet erosion on the surface is resulting in pediceled pavement (fig. 8). The forb Ivesia gordonii appears to be the only species capable of colonizing these sites.

Figure 7. LaBarge Meadows seed trial site, looking northwest. Reestablishment of Artemisia, with scattered clumps of Agropyron intermedium and Arrhenatherum elatius. Agropyron cristatum appears as dense, light tan culms in the middleground. Date 9-11-81

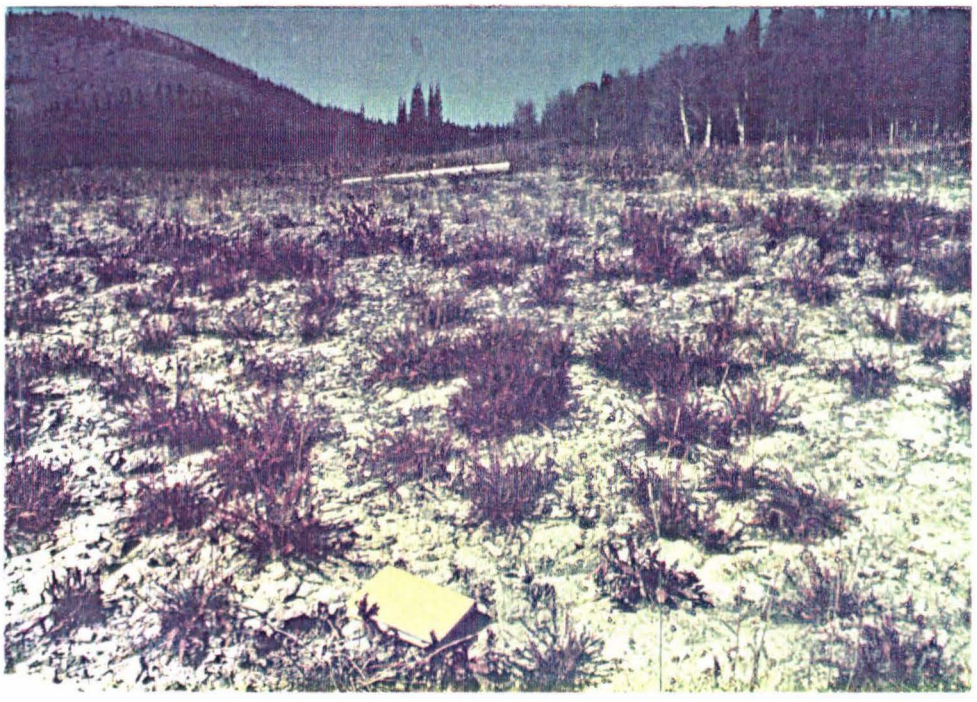

Figure 8. LaBarge Meadows facing south. Planting failure. Ivesia gordonii appears in the foreground; Geranium viscosissimum and Balsamorhiza macrophylla are dominants in the background. Date 9-11-81

Individual Species: All wheatgrasses were considered a failure at McCain. At the other sites, Agropyron intermedium proved successful, rating at least a good (7-8) immediately following planting. This rating persisted for five to seventeen years before a gradual decline, indicating a fairly wide ecological amplitude. A. trichophorum reacted somewhat better than A. intermedium on the drier sites, such as Cabin Creek and Smiths Fork. It survived only a few years at the more mesic sites at LaBarge Meadows and Blind Bull. A. smithii, A. trachycaulum and A. cristatum should be considered failures.

Alopecurus pratensis appears to have a high affinity for sites with abundant moisture, such as both high elevation trials (Blind Bull and LaBarge Meadows). It was most successful at Blind Bull, with excellent early establishment. It was the dominant species (75 percent cover) as early as 1967. At the same time, A. pratensis accounted for about 20 percent cover at McCain, presumably as a result of subirrigation. The results at Cabin Creek are more difficult to interpret. It was much slower in establishment, although finally rating a medium in 1967 with 30 percent cover. This has remained constant through 1981. The Smiths Fork site presumably presents sufficient droughtiness of soils to prevent germination and establishment.

Several brome species were tested on the different trials. Bromus inermis was included in either a mix or pure species plot at each of the five trial sites. It proved to have good establishment following planting at McCain, with a slow gradual decline beginning in 1961. Apparently it increased in vigor again, resulting in about fifty percent of the cover by 1967. Although the individual plot ratings at Cabin Creek indicate similar longevity, it never reached the same dominance in cover. The same pattern as Cabin Creek existed at Blind Bull and LaBarge Meadows; medium to good ratings for the first fifteen to twenty-five years, and then a gradual decline. In contrast, B. inermis at Smiths Fork developed much the same as at McCain; a slow but steady increase resulting in about eighty percent cover in 1981. Based upon these and other sites, A.C. Hull (1974) has reported upon the failure of B. inermis to maintain itself in stands above 9,000-foot (2745 m) elevations. Bromus carinatus was rated medium to good at both McCain and Blind Bull immediately following treatment. At both sites there was a slow and gradual decline; it now accounts for about five percent cover at Blind Bull. Other tests of Bromus, including B. tomentellus and B. erectus were failures.

Other grasses of interest include Dactylis, Phleum, and Arrhenatherum. Both Dactylis glomerata and Phleum pratense germinated well; first to third year rating were as high as excellent (10). However, at LaBarge Meadows, Cabin Creek, Blind Bull and McCain, both species failed to maintain a viable stand after about the third year. This would seem predictable, assuming both species are better adapted to irrigated pastureland. Arrhenatherum elatius was a failure at Smiths Fork, had excellent germination and establishment at McCain, similar to the previous two species, but was rated much lower (medium to very poor) at Blind Bull, Cabin Creek, and LaBarge. Discounting the failure of Arrhenatherum at Smiths Fork, it appears that each of these three species may play a potentially beneficial role in a revegetation prescription. If considered as a nursecrop, they may supply some temporary stabilization and protection to high elevation sites. However, a full stand development should not be expected.

Testing of forbs concentrated on native and introduced members of the Fabaceae (Leguminosae) family. They should all be considered failures.

Rodents: The propensity of rodents, primarily pocket gophers (Thomomys spp.) for feeding on fleshy-rooted forbs and grasses is well documented (Barns 1974, Buchner and Rorabaugh 1979, Volland 1977). Native grass and forb reestablishment on the trial sites provided ample forage. Planting techniques, primarily plowing, also probably encouraged gopher activity. Exclosures were established at each of the sites; their overall effectiveness is questionable. Observations through 1961 indicate a statistically significant difference between protected and unprotected plots (Student's t test, $P > 0.05$). Average rating for protected plots was 7.1, with a standard deviation of 2.17, while unprotected plots rated only 3.8, with a standard deviation of 2.15. Recorded observations fail, however, to indicate differences between individual species or mixtures.

SUMMARIZATION AND RECOMMENDATIONS

It is disappointing and somewhat surprising that observations of the planted species did not receive as much attention as the original study designs indicated. As previously noted, effects of different site preparations, planting techniques, mulches, and protection methods were nullified through the reporting of a single numeral for each species at each trial site. It is therefore impossible to elucidate the factor or factors responsible for each species reaction to planting. Generalizations and recommendations are therefore tenuous, and involve personal observations and test results reported elsewhere (Laycock 1982, Long 1981, Plummer and others 1968, Thornburg 1982).

Both Bromus inermis and Alopecurus pratensis appear to be excellent species for consideration in a revegetation prescription. Alopecurus can develop almost complete dominance on sites with abundant precipitation or ground moisture. On the Bridger-Teton National Forest, it should be fairly successful in the Abies lasiocarpa/Vaccinium globulare and more moist habitat types in the Abies series, most of the Picea and Pinus albicaulis series, and possibly the wetter portions of the Pseudotsuga menziesii/Symphoricarpos albus and P. menziesii/Acer glabrum habitat types. Throughout the Forest it may also become established in planting on subirrigated sites or moist meadows at high elevations. Bromus inermis appears to be a slow invader that is easily established throughout much of the Populus type, most of the Pseudotsuga series, and much of the Abies series below 9,000 feet (2745 m). It appears to be one of the longest lived species of all those tested. Because of the density of sod produced, B. inermis may prevent native species from gradually invading the planted site.

Both introduced wheatgrasses reacted similarly. They were moderately easy to establish on drier sites within the Populus type and throughout the Artemisia tridentata-vaseyana series. Agropyron trichophorum should be favored on the more droughty sites such as in the A. t.-vaseyana/Agropyron spicatum habitat type, whereas Agropyron intermedium appears successful in the A. t.-vaseyana/Festuca idahoensis habitat type and most mountain shrub types. Longevity of stands is fairly short; land managers should plan on losing these species from the site in five to ten years. This may be extremely beneficial if the native species composition is desirable.

Plantings of Dactylis, Phleum pratense or Arrhenatherum elatius may be considered for immediate site protection and a nurse crop. Longevity of stands beyond a few years is highly speculative. Both Dactylis and Phleum are favored by higher moisture tables, such as subirrigated meadows, riparian zones, or wet toeslopes.

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APPENDIX

Table 1. List of species planted by site.

McCain Meadows

Agropyron cristatum	Fairway or crested wheatgrass
Agropyron elongatum	Tall wheatgrass
Agropyron intermedium	Intermediate wheatgrass
Agropyron trachycaulum	Slender wheatgrass
Alopecurus arundinaceus	Reed foxtail
Alopecurus pratensis	Meadow foxtail
Arrhenatherum elatius	Tall oatgrass
Astragalus cicer	Chickpea milkvetch
Bromus carinatus	Mountain brome
Bromus inermis	Smooth brome
Bromus tomentellus	Subalpine brome
Dactylis glomerata	Orchardgrass
Lotus corniculatus	Birdsfoot deervetch
Medicago sativa	Alfalfa
Melilotus officinalis	Yellow sweetclover
Osmorhiza occidentalis	Sweetanise
Phleum pratense	Timothy

Cabin Creek

Agropyron intermedium	Intermediate wheatgrass
Agropyron trachycaulum	Slender wheatgrass
Agropyron trichophorum	Pubescent wheatgrass
Alopecurus pratensis	Meadow foxtail
Arrhenatherum elatius	Tall oatgrass
Astragalus cicer	Chickpea milkvetch
Astragalus falcatus	Sicklepod milkvetch
Bromus carinatus	Mountain brome
Bromus inermis	Smooth brome
Dactylis glomerata	Orchard grass
Festuca ovina var. duriuscula	Hard fescue
Lathyrus sylvestris	Flat peavine
Lotus corniculatus	Birdsfoot deervetch
Medicago sativa	Alfalfa
Phleum pratense	Timothy

Blind Bull

Agropyron cristatum	Fairway or crested wheatgrass
Agropyron elongatum	Tall wheatgrass
Agropyron intermedium	Intermediate wheatgrass
Agropyron trachycaulum	Slender wheatgrass
Agropyron trichophorum	Pubescent wheatgrass
Alopecurus arundinaceus	Reed foxtail
Alopecurus pratensis	Meadow foxtail
Arrhenatherum elatius	Tall oatgrass

Table 1 Continued

Bromus carinatus	Mountain brome
Bromus inermis	Smooth brome
Bromus tomentellus	Subalpine brome
Dactylis glomerata	Orchardgrass
Festuca ovina var. duriuscula	Hard fescue
Melilotus officinalis	Yellow sweetclover
Phleum pratense	Timothy
Osmorhiza occidentalis	Sweetanise

Smiths Fork

Agropyron anurense	Unknown
Agropyron intermedium	Intermediate wheatgrass
Agropyron trachycaulum	Slender wheatgrass
Agropyron trichophorum	Pubescent wheatgrass
Alopecurus pratensis	Meadow foxtail
Arrhenatherum elatinus	Tall outgrass
Astragalus cicer	Chickpea milkvetch
Bromus carinatus	Mountain brome
Bromus erectus	Meadow brome
Bromus inermis	Smooth brome
Dactylis glomerata	Orchardgrass
Medicago sativa	Alfalfa
Phleum pratense	Timothy

LaBarge Creek

Agropyron cristatum	Fairway or crested wheatgrass
Agropyron intermedium	Intermediate wheatgrass
Agropyron smithii	Western wheatgrass
Agropyron subsecundum	Bearded wheatgrass
Agropyron trachycaulum	Slender wheatgrass
Agropyron trichophorum	Pubescent wheatgrass
Alopecurus arundinaceus	Reed foxtail
Alopecurus pratensis	Meadow foxtail
Arrhenatherum elatius	Tall oatgrass
Astragalus chinensis	China milkvetch
Bromus carinatus	Mountain brome
Bromus erectus	Meadow brome
Bromus inermis	Smooth brome
Bromus inermis - Lincoln	Smooth brome (Lincoln)
Bromus tomentellus	Subalpine brome
Dactylis glomerata	Orchardgrass
Elymus condensatus	Giant wildrye
Elymus triticoides	Creeping wildrye
Lupinus alpestris	Mountain lupine
Melilotus officinalis	Yellow sweetclover
Phalaris arundinacea	Reed canary grass
Phleum pratense	Timothy
Stipa columbiana	Subalpine needlegrass
Stipa lettermani	Letterman needlegrass

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